

## CLAIMS

What is claimed is

- 1        1.    A robotic master handle assembly that has only  
2 five degrees of freedom, comprising:  
3        a spinning handle;  
4        a wrist joint coupled to said handle;  
5        a translator that is coupled to said wrist joint;  
6        an elbow joint coupled to said translator; and  
       a shoulder joint coupled to said elbow joint.
- 1        2.    The assembly of claim 1, wherein said handle is  
2 manipulated by a user's hand that has a centroid located  
3 between a thumb, an index finger and a middle finger, said  
4 wrist joint allows said handle to rotate about a wrist axis  
5 that intersects the roll axis at the centroid of the user's  
6 hand.
- 1        3.    The assembly of claim 1, wherein said handle  
2 includes a grasper that is coupled to a handle housing,  
3 said grasper includes a pair of grooves and said handle  
4 housing includes a groove.

1           4.    The assembly of claim 3, wherein said grasper  
2 includes a switch.

1           5.    The assembly of claim 3, wherein said handle  
2 housing includes a plurality of buttons.

1           6.    A robotic master handle assembly that has only five  
2 degrees of freedom, comprising:

3           handle means for being rotated about a roll axis;

4           wrist means for allowing rotation of said handle means  
5 about a wrist axis;

6           translator means for allowing translation of said wrist  
7 means and said handle means;

8           elbow means for allowing rotation of said translator  
9 means, said wrist means and said handle means about an  
10 elbow axis; and,

11          shoulder means for allowing rotation of said elbow  
12 means, said translator means, said wrist means and said  
13 handle means about a shoulder axis.

1           7. The assembly of claim 6, wherein said handle means  
2 is manipulated by a user's hand that has a centroid located  
3 between a thumb, an index finger and a middle finger, and  
4 the wrist axis intersects the roll axis at the centroid of  
5 the user's hand.

1           8. The assembly of claim 6, wherein said handle means  
2 includes a grasper that is coupled to a handle housing,  
3 said grasper includes a pair of grooves and said handle  
4 housing includes a groove.

1           9. The assembly of claim 8, wherein said grasper  
2 includes a switch.

1           10. The assembly of claim 8, wherein said handle  
2 housing includes a plurality of buttons.

1           11. A robotic system with a master handle assembly  
2 that has only five degrees of freedom, comprising:  
3 a robotic arm;  
4 a medical instrument coupled to said robotic arm;

5 a controller coupled to said robotic arm and said  
6 medical instrument;  
7 a spinning handle coupled to said controller;  
8 a wrist joint that is coupled to said handle;  
9 a translator that is coupled to said wrist joint;  
10 an elbow joint coupled to said translator; and,  
11 a shoulder joint coupled to said wrist joint.

1 12. The system of claim 11, wherein said handle is  
2 manipulated by a user's hand that has a centroid located  
3 between a thumb, an index finger and a middle finger, said  
4 wrist allows the handle to be rotated about a wrist axis  
5 that intersects the roll axis at the centroid of the user's  
6 hand.

1 13. The system of claim 11, wherein said handle  
2 includes a grasper that coupled to a handle housing, said  
3 grasper includes a pair of grooves and said handle housing  
4 includes a groove.

1 14. The system of claim 13, wherein said grasper  
2 includes a switch.

1        15. The system of claim 13, wherein said handle  
2 housing includes a plurality of buttons.

1        16. A robotic system, comprising:

2        a medical instrument;

3        robotic means for moving said medical instrument;

4        handle means for being rotated about a roll axis to  
5 spin the medical instrument;

6        wrist means for allowing rotation of said handle means  
7 about a wrist axis to move said medical instrument;

8        translator means for allowing translation of said wrist  
9 means and said handle means to translate said medical  
10 instrument;

11       elbow means for allowing rotation of said translator  
12 means, said wrist means and said handle means, to move said  
13 medical instrument;

14       shoulder means for allowing rotation of said elbow  
15 means, said translator means, said wrist means and said  
16 handle means, to move said medical instrument.

1           17. The system of claim 16, wherein said handle means  
2 is manipulated by a user's hand that has a centroid located  
3 between a thumb, an index finger and a middle finger, said  
4 wrist allows said handle to rotate about a wrist axis that  
5 intersects the roll axis at the centroid of the user's  
6 hand.

1           18. The system of claim 16, wherein said handle means  
2 includes a grasper that is coupled to a handle housing,  
3 said grasper includes a pair of grooves and said handle  
4 housing includes a groove.

1           19. The system of claim 18, wherein said grasper  
2 includes a switch.

1           20. The system of claim 18, wherein said handle  
2 housing includes a plurality of buttons.

1           21. A method for operating a master handle assembly  
2 that has only five degrees of freedom, comprising:  
3           rotating a handle about a roll axis;

4 rotating the handle about a wrist axis;  
5 translating the handle relative to a translation axis;  
6 rotating the handle about an elbow axis; and,  
7 rotating the handle about a shoulder axis.

1 22. The method of claim 21, wherein rotating the  
2 handle spins a medical instrument.

1 23. The method of claim 21, wherein rotating the  
2 handle about the wrist axis moves a medical instrument.

1 24. The method of claim 21, wherein moving the wrist  
2 and handle along the translation axis moves a medical  
3 instrument.

1 25. A robotic system, comprising:  
2 a robotic arm;  
3 a medical instrument coupled to said robotic arm, said  
4 medical instrument pivots about a pivot point located at an  
5 incision of a patient;  
6 a handle; and,

7 a translator coupled to said handle, said translator  
8 allows movement of said handle relative to a translator  
9 axis;  
10 an elbow coupled to said translator, to allow movement  
11 of said handle about an elbow axis that intersects with the  
12 translator axis;  
13 a shoulder coupled to said elbow to allow movement of  
14 said handle about a shoulder axis that intersects the elbow  
15 axis and the translator axis; and,  
16 a controller coupled to said robotic arm, said  
17 translator, said elbow and said shoulder to control  
18 movement of said surgical instrument such that the  
19 intersection of the translator, elbow and shoulder axis  
20 corresponds to the pivot point.

1 26. The system of claim 25, further comprising a wrist  
2 that allows said handle to be rotated about a wrist axis,  
3 said handle spins about a roll axis, wherein said handle is  
4 manipulated by a user's hand that has a centroid located  
5 between a thumb, an index finger and a middle finger, and  
6 the wrist axis intersects the roll axis at the centroid of  
7 the user's hand.



1        27. The system of claim 26, wherein said handle  
2 includes a grasper that is coupled to a handle housing,  
3 said grasper includes a pair of grooves and said handle  
4 housing includes a groove.

1        28. The system of claim 27, wherein said grasper  
2 includes a switch.

1        29. The system of claim 25, wherein said handle  
2 housing includes a plurality of buttons.

1        30. A robotic system, comprising:  
2        a medical instrument that pivots about a pivot point  
3 located at an incision of a patient;  
4        robotic means for moving said medical instrument;  
5        handle means for being rotated about a roll axis to  
6 spin said medical instrument;  
7        translator means for allowing movement of said handle  
8 means relative to a translator axis;  
9        elbow means for allowing rotation of said handle means  
10 about an elbow axis that intersects the translator axis;

11 shoulder means for allowing rotation of said handle  
12 means about a shoulder axis that intersects the translator  
13 axis; and,  
14 controller means for moving said robotic means in  
15 response to movement of said handle means wherein the  
16 intersection of the translation, elbow and shoulder axis  
17 corresponds to the pivot point.

1 31. The system of claim 30, further comprising wrist  
2 means for allowing said handle means to be rotated about a  
3 wrist axis, said handle means spins about a roll axis,  
4 wherein said handle means is manipulated by a user's hand  
5 that has a centroid located between a thumb, an index  
6 finger and a middle finger, and the wrist axis intersects  
7 with the roll axis at the centroid of the user's hand.

1 32. The system of claim 31, wherein said handle means  
2 includes a grasper that is coupled to a handle housing,  
3 said grasper includes a pair of grooves and said handle  
4 housing includes a groove.

1        33. The system of claim 31, wherein said grasper  
2 includes a switch.

1        34. The system of claim 31, wherein said handle  
2 housing includes a plurality of buttons.

1        35. A method for operating a master handle assembly,  
2 comprising:

3        moving a handle about a translator axis, an elbow axis  
4 and a shoulder axis that intersect; and,  
5        moving a medical instrument about a pivot point located  
6 at an incision of a patient wherein the pivot point  
7 corresponds to the intersection of the translation, elbow  
8 and shoulder axes.

1        36. A handle for a medical robotic system, comprising:  
2 an elliptical shaped handle housing; and,  
3 a grasper coupled to said elliptical shaped housing.

1        37. The handle of claim 36, wherein said elliptical  
2 shaped handle has a plurality of buttons.

1        38. The handle of claim 36, wherein said grasper  
2 includes a switch that locks the grasping in a desired  
3 position.

1        39. A master robotic handle assembly that has only  
2 five degrees of freedom, comprising:  
3        a handle;  
4        a first joint that provides a first degree of freedom  
5 for said handle;  
6        a second joint that provides a second degree of freedom  
7 for said handle;  
8        a third joint that provides a third degree of freedom  
9 for said handle;  
10       a fourth joint that provides a fourth degree of freedom  
11 for said handle; and,  
12       a fifth joint that provides a fifth degree of freedom  
13 for said handle.

1       40. A master robotic handle assembly that has only five  
2 degrees of freedom, comprising:  
3       a handle;

4 first means for providing said handle with a first  
5 degree of freedom;  
6 second means for providing said handle with a second  
7 degree of freedom;  
8 third means for providing said handle with a third  
9 degree of freedom;  
10 fourth means for providing said handle with a fourth  
11 degree of freedom; and,  
12 fifth means for providing said handle with a fifth  
13 degree of freedom.

14 41. A robotic system that has only five degrees of  
15 freedom, comprising:  
16 a robotic arm;  
17 a medical instrument which has an end effector that can  
18 move in a first direction, a second direction, a third  
19 direction, a fourth direction and a fifth direction;  
20 a handle that has a first degree of freedom that  
21 corresponds to movement of said end effector in the first  
22 direction, a second degree of freedom that corresponds to  
23 movement of said end effector in the second direction, a  
24 third degree of freedom that corresponds to movement of

12 said end effector in the third direction, a fourth degree  
13 of freedom that corresponds to movement of said end  
14 effector in the fourth direction, and a fifth degree of  
15 freedom that corresponds to movement of said end effector  
16 in the fifth direction.

1 42. A method for operating a robotic system that has  
2 only five degrees of freedom, comprising:

3 moving a handle about a first degree of freedom to move  
4 an end effector of a medical instrument in a first  
5 direction;

6 moving the handle about a second degree of freedom to  
7 move the end effector in a second direction;

8 moving the handle about a third degree of freedom to  
9 move the end effector in a third direction;

10 moving the handle about a fourth degree of freedom to  
11 move the end effector in a fourth direction; and,

12 moving the handle about a fifth degree of freedom to  
13 move the end effector in a fifth direction.